

**Laser Imprint and Implications for Direct Drive Ignition with the National Ignition Facility\*** S. V. Weber, S. G. Glendinning, D. H. Kalantar, B. A. Remington, J. E. Rothenberg, *Lawrence Livermore National Laboratory*, M. H. Key, *Rutherford Appleton Laboratory*, and J. P. Knauer, *Laboratory for Laser Energetics, University of Rochester* - For direct drive ICF, nonuniformities in laser illumination can seed ripples at the ablation front in a process called "imprint". Such nonuniformities will grow during the capsule implosion and can penetrate the capsule shell, impede ignition, or degrade burn. Imprint has been measured on Nova for planar CH<sub>2</sub> foils probed with a thermal (U) x-ray backlighter at ~1.5 keV. These foils were illuminated with 0.53 or 0.35  $\mu\text{m}$  light using random phase plates, with or without SSD smoothing. Imprint has also been measured on Nova for 3  $\mu\text{m}$  thick Si foils probed with a Y XUV laser, and on Vulcan for 2  $\mu\text{m}$  thick Al foils probed with a Ge XUV laser. A variety of illumination and beam smoothing schemes have been examined, with particular emphasis upon conditions similar to the early part of an ignition capsule pulse shape,  $I \cong 10^{13} \text{ W/cm}^2$ . We will present results for these imprint measurements and comparisons with simulations. We have also simulated imprint upon National Ignition Facility (NIF) direct drive ignition capsules. We will show simulated imprint amplitudes and resulting shell modulation through the course of the implosion. Implications for beam smoothing requirements for NIF will be discussed. Imprint modulation amplitudes comparable to the intrinsic surface finish of ~40 nm should be achievable. This level of beam smoothness should be adequate for direct drive capsules to ignite and burn.

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\* Work performed under the auspices of the U. S. Department of Energy by the Lawrence Livermore National Laboratory under Contract W-7405-ENG-48.